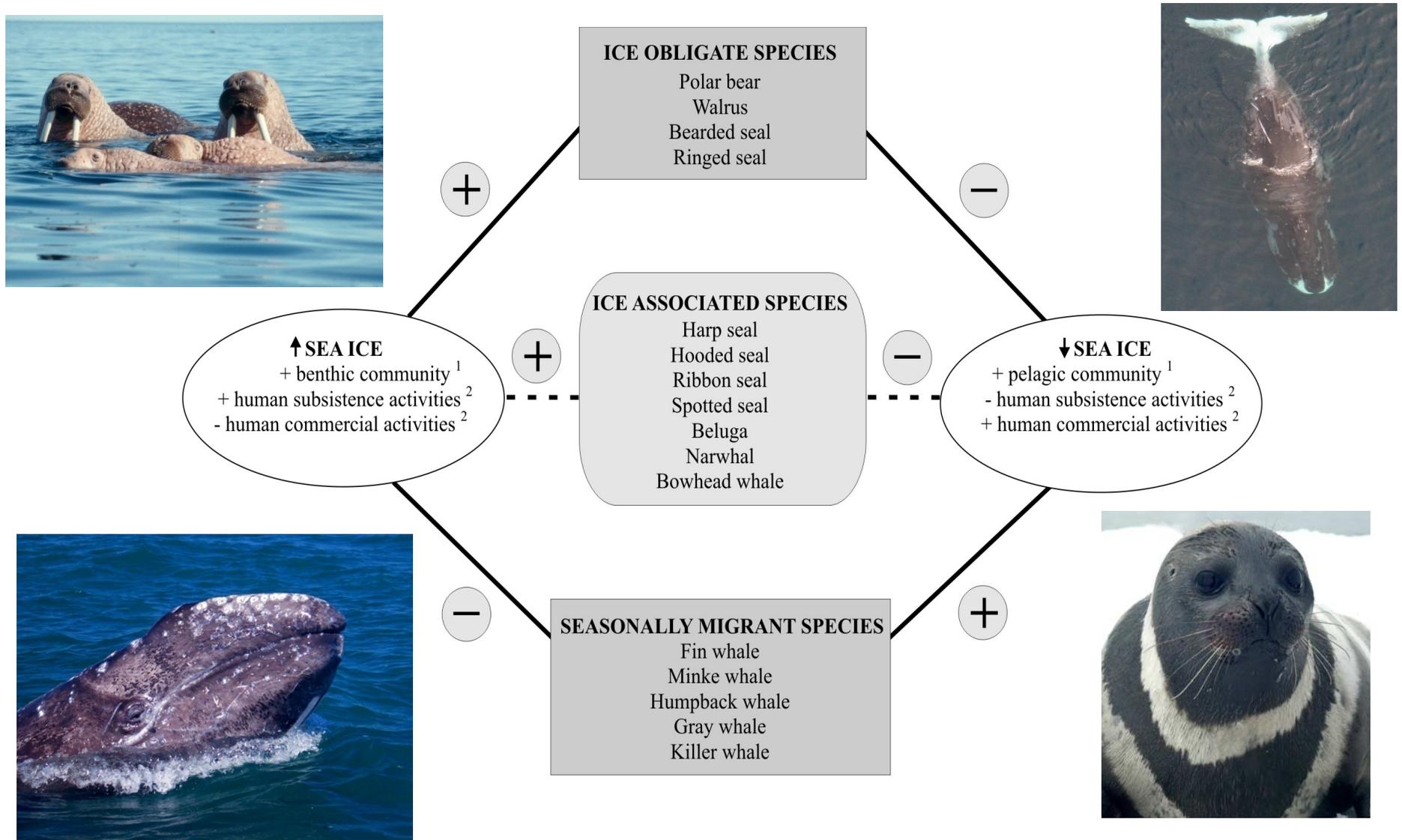


# Upper Trophic Levels (Marine mammals, birds, fish, and reptiles/amphibians)

Robert Suydam and Robyn Angliss  
SOAR  
March 2012

# Marine Mammals and Sea Ice

Moore and Huntington 2008 *Ecological Applications*



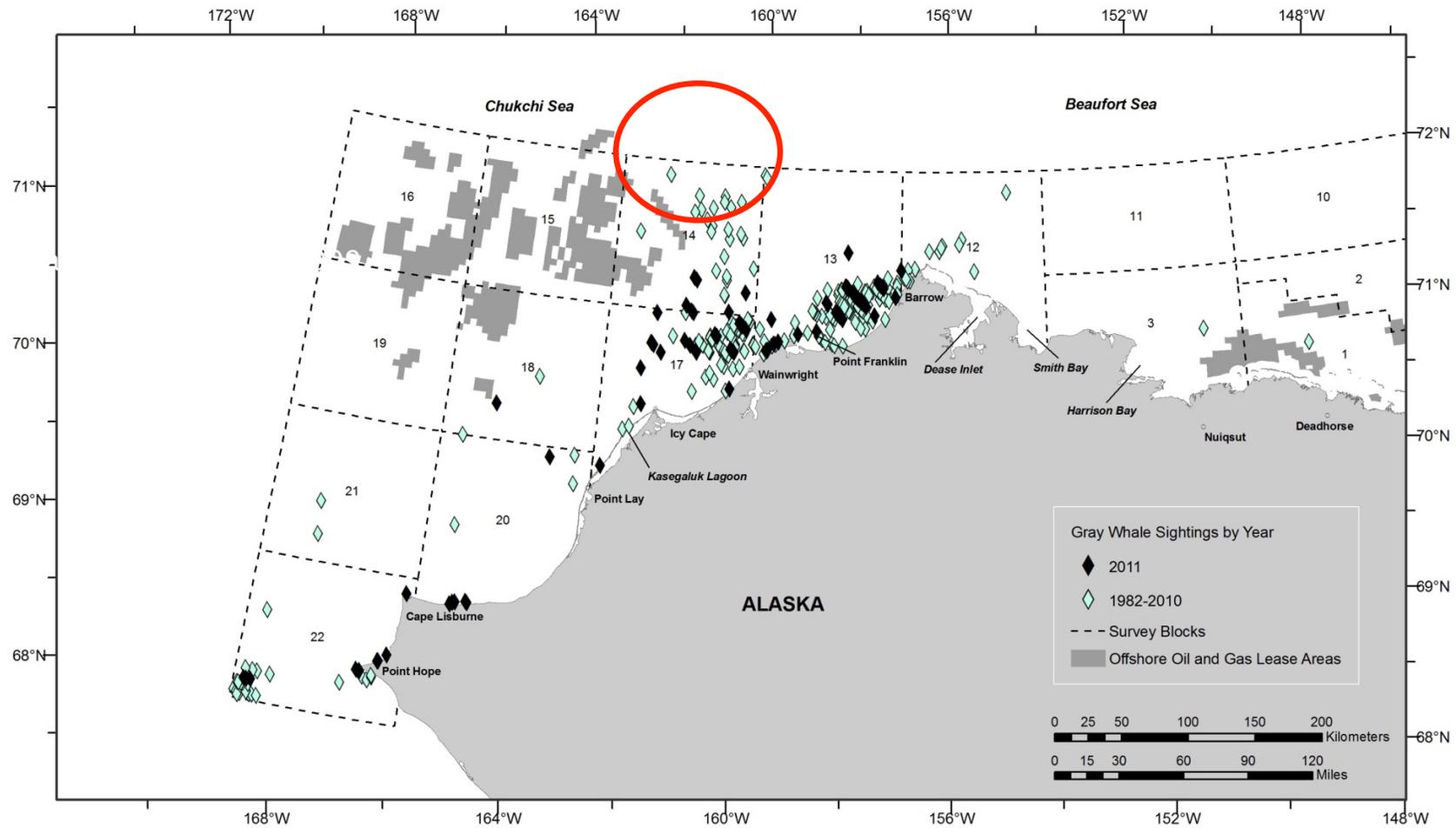
## Marine mammals of the high Arctic

<u>Species</u>	<u>Abundance estimate in C/B</u>	<u>ESA &amp; MMPA status</u>
Bowhead whale	~12,400	Endangered, Depleted
Beluga whale	39,258; 3,710; 28,406; 2,877	
Gray whale	19,126	
<i>Narwhal</i>	N/A	
<i>Minke whale</i>	N/A	
<i>Humpback whale</i>	N/A	<i>Endangered , Depleted</i>
<i>Harbor porpoise</i>	N/A	
<i>Fin whale</i>	N/A	<i>Endangered , Depleted</i>
<i>Dall's porpoise</i>	N/A	
<i>Killer whale</i>	N/A	
Bearded seal	N/A	Proposed Threatened
Ribbon seal	49,000 (provisional)	
Ringed seal	N/A	Proposed Threatened
Spotted seal	N/A	
Polar bear	1,526; 2,000	Threatened
Walrus	N/A	

# Acoustics

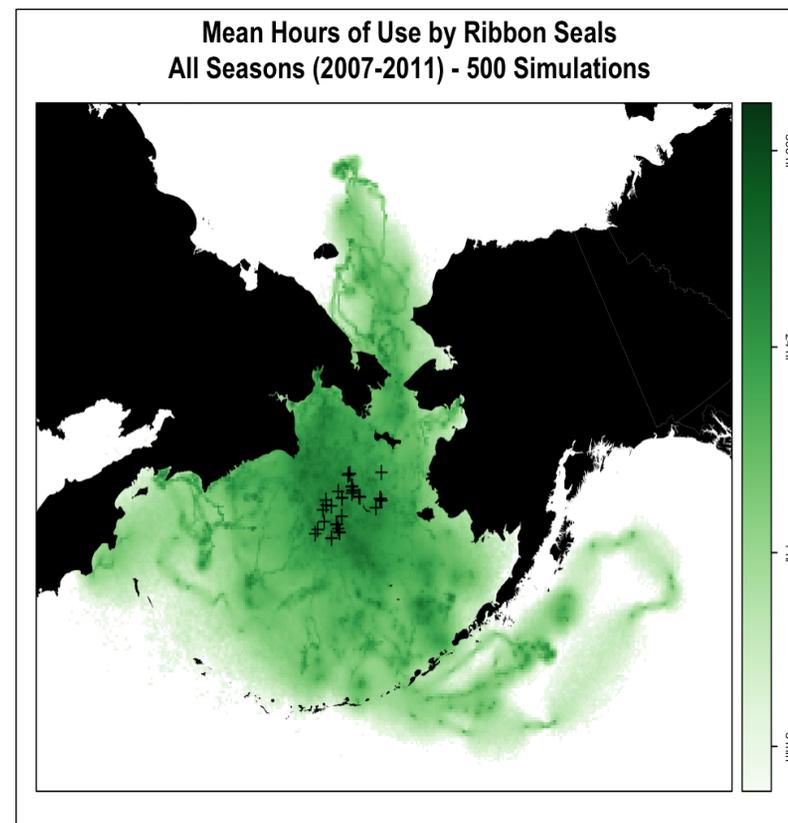
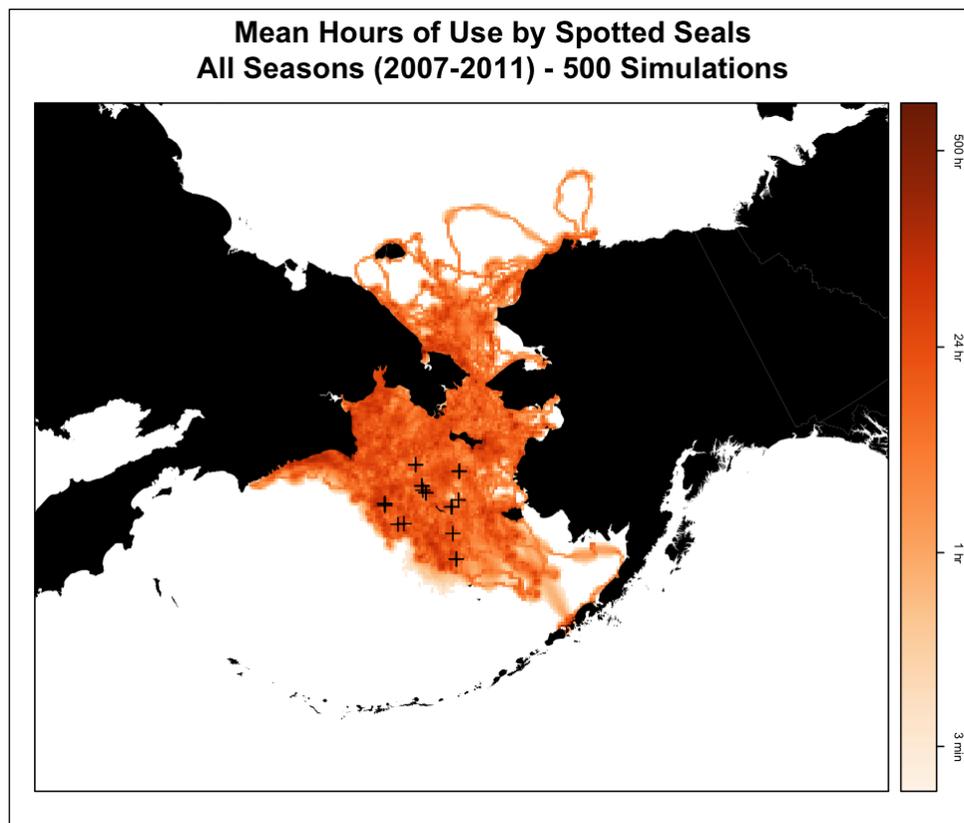


# 1982-1991, 2008-2011 ASAMM Gray Whale Sightings\* Years with Light Ice Coverage

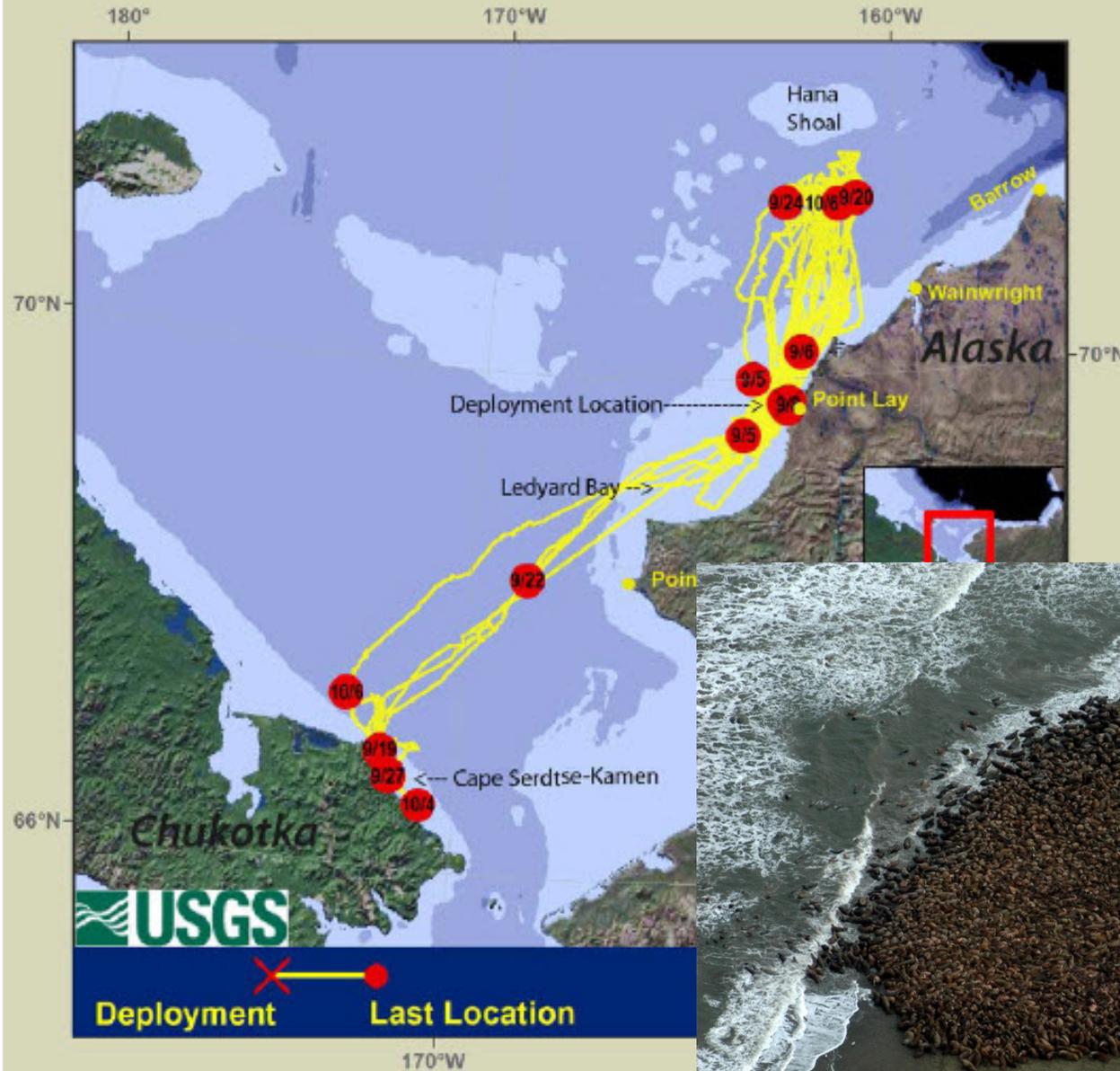


\* Transect only

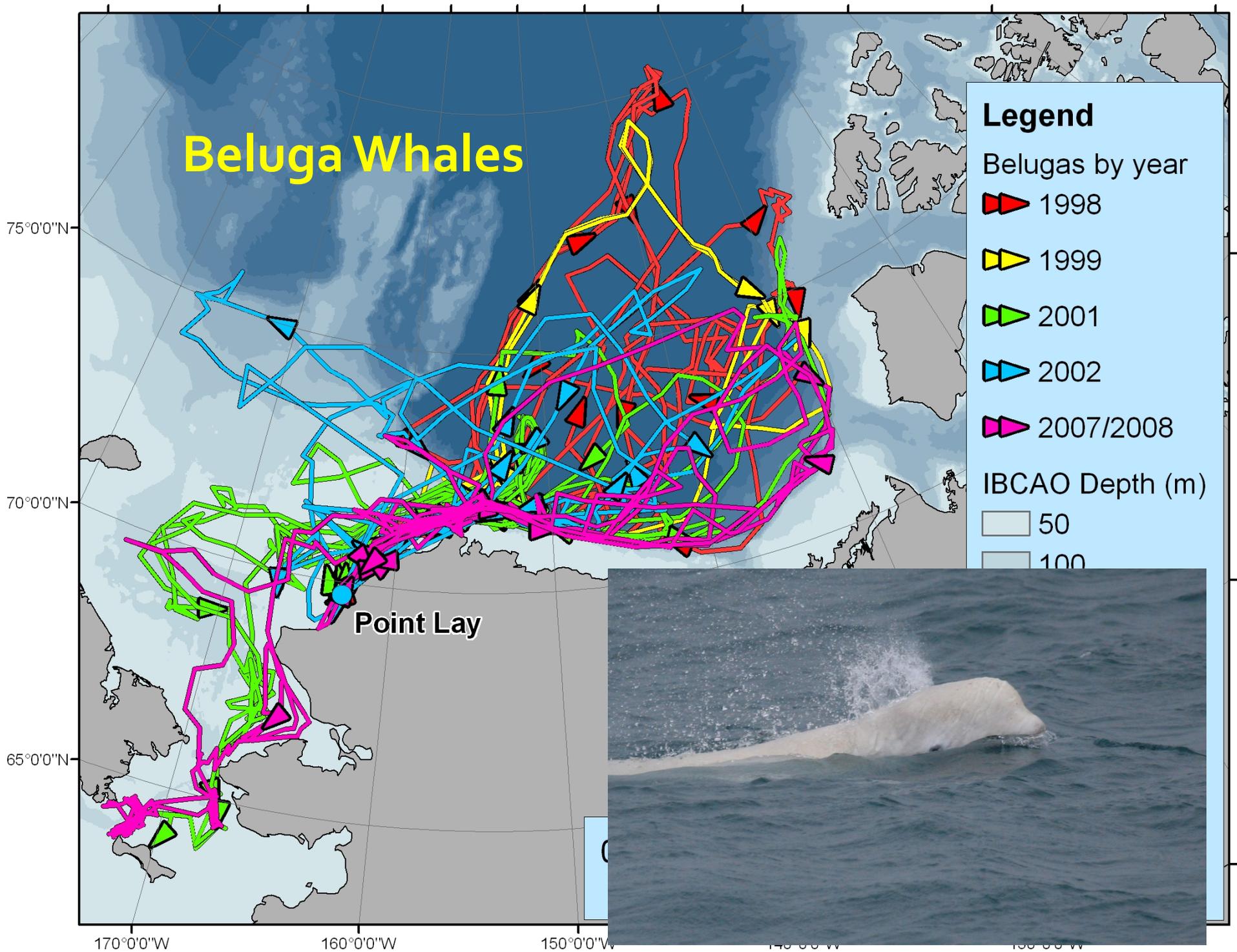
# Spotted and ribbon seal habitat use



# Walrus



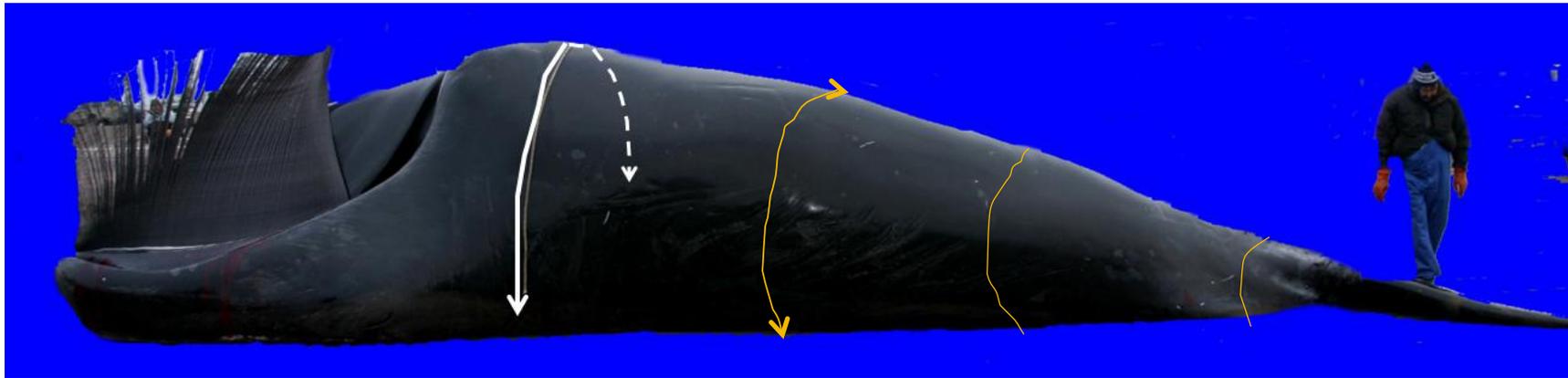
# Beluga Whales



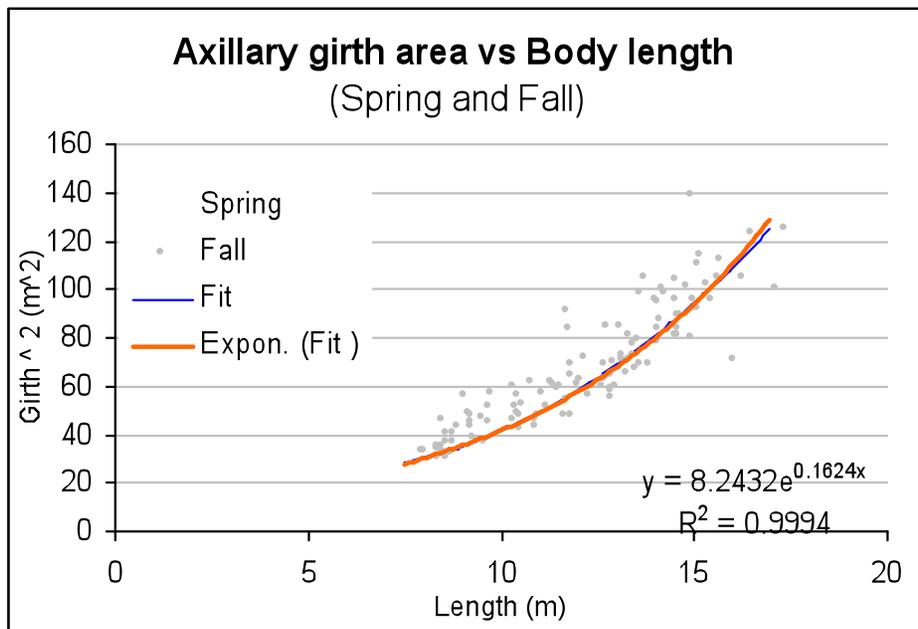
# Sea Ice Density and Bowhead Whale Body Condition

*J.C. George, M. Drukenmiller, R. Suydam, K. Laidre, C. Nicolson*



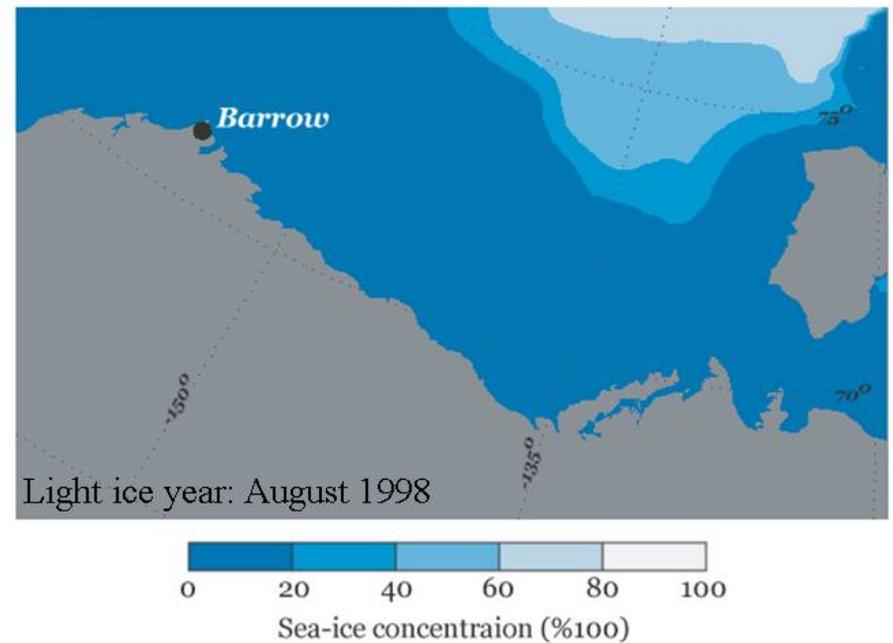
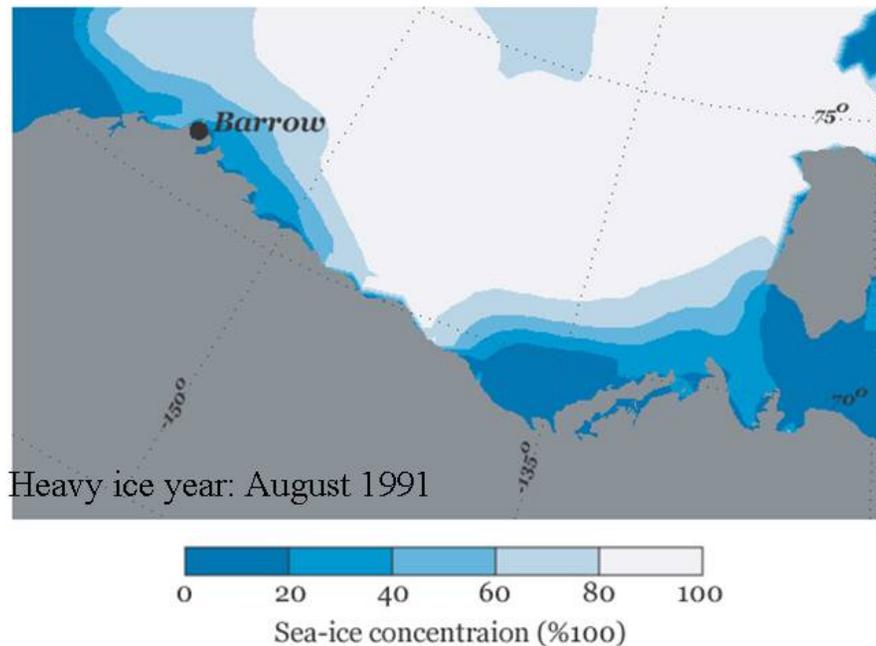
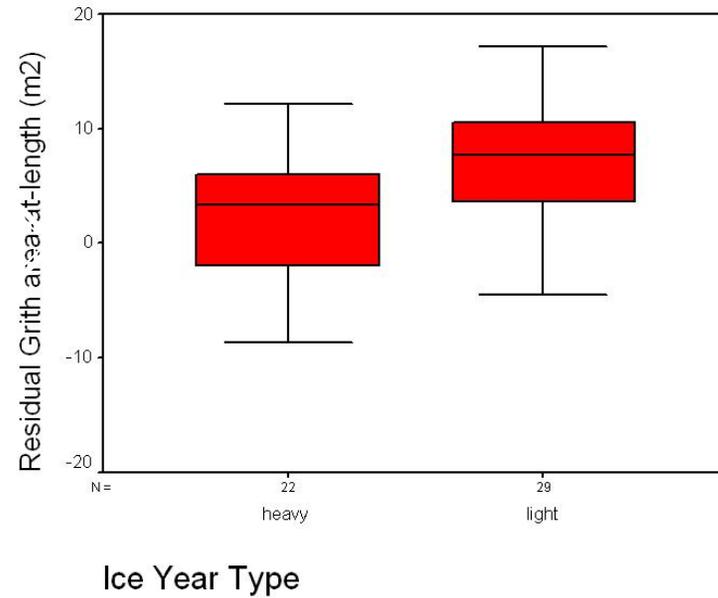


Axillary, umbilical, and anal girth measurements over three decades.



In first study (2005), individual BCI was estimated as the residual from the fitted Length/Girth model

Initial study found a significant difference in BCI between heavy and light ice years.



# TOTAL DISTRIBUTION SEABIRDS

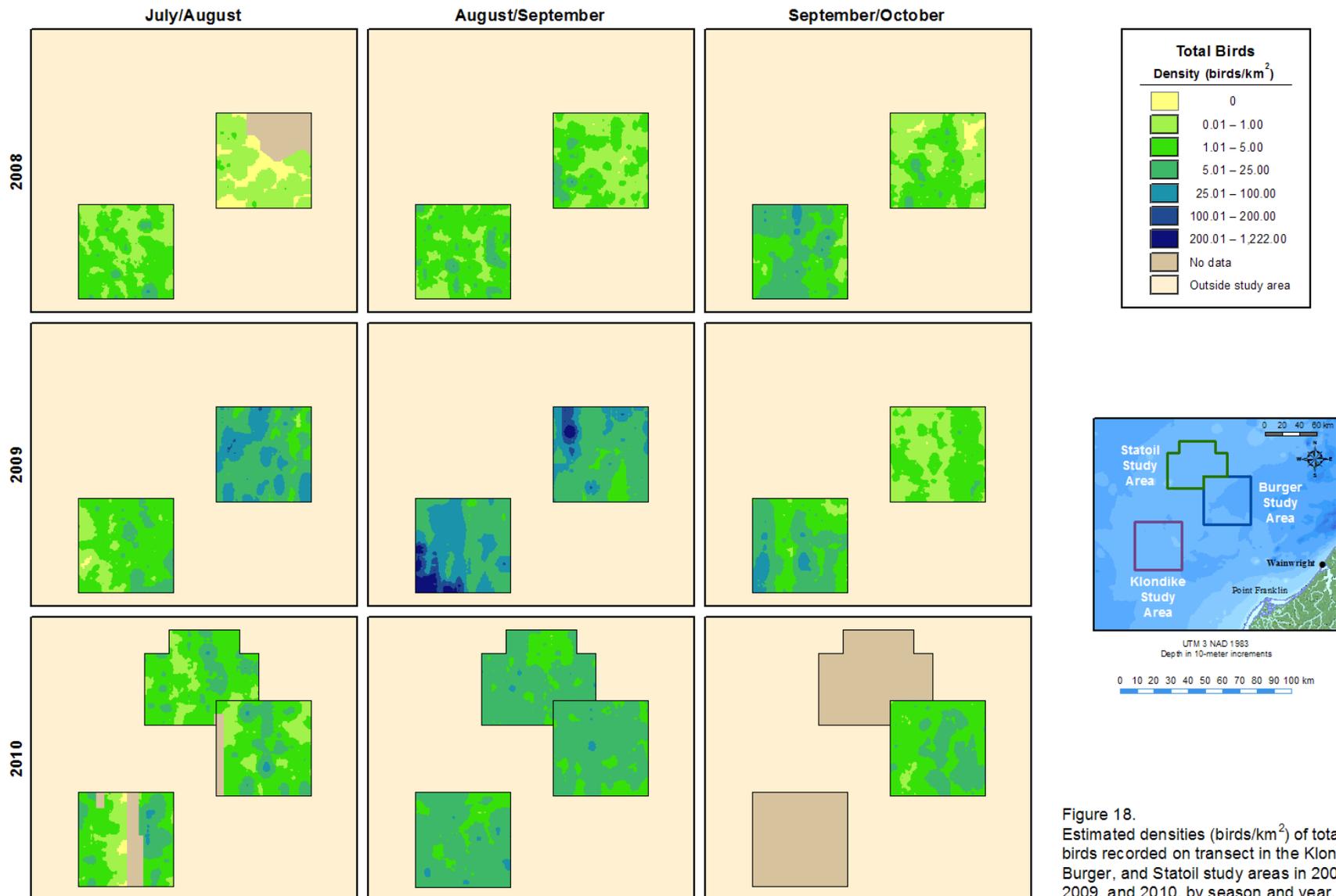


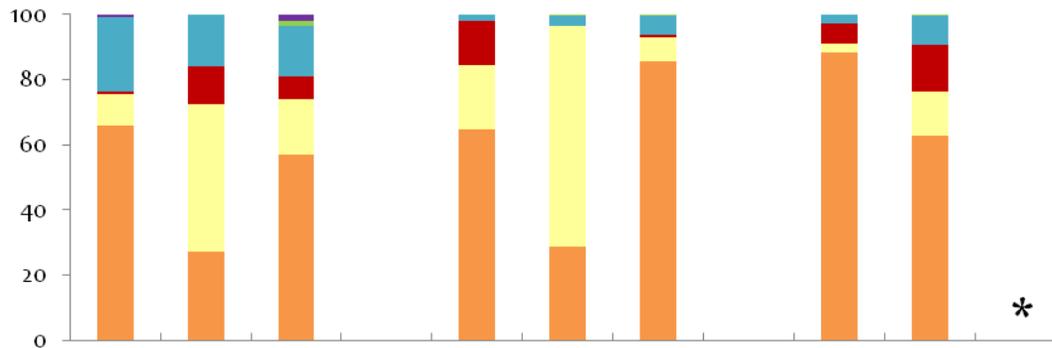
Figure 18. Estimated densities (birds/km<sup>2</sup>) of total birds recorded on transect in the Klondike, Burger, and Statoil study areas in 2008, 2009, and 2010, by season and year.

# TOTAL ABUNDANCE

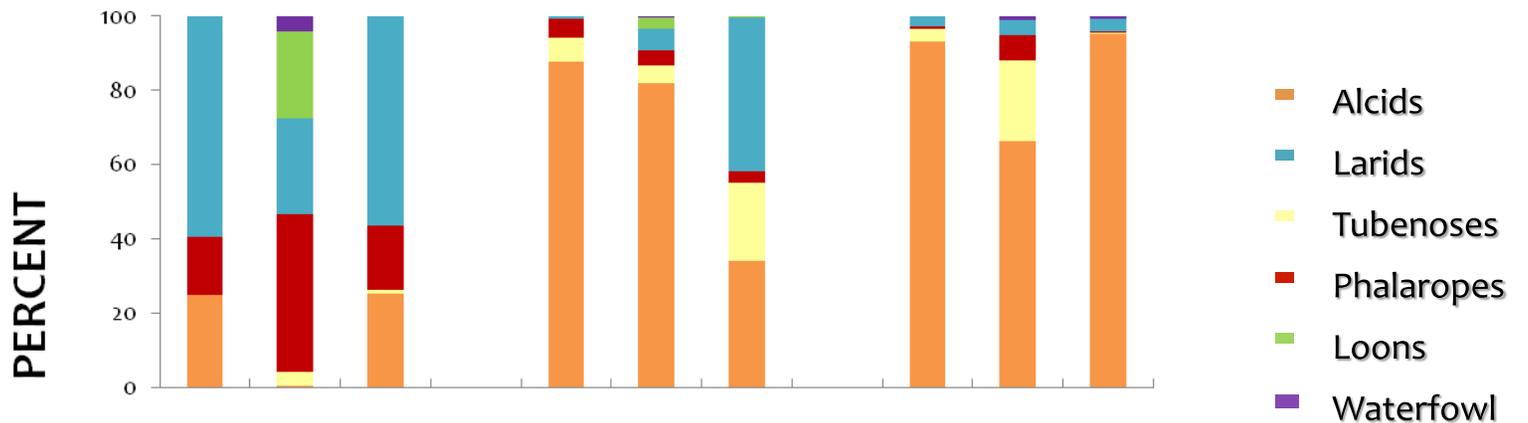
- $80,000 \pm 23,000$  birds of 31 species in 2008
- $538,000 \pm 100,000$  birds of 24 species in 2009
- $217,000 \pm 48,000$  birds of 29 species in 2010



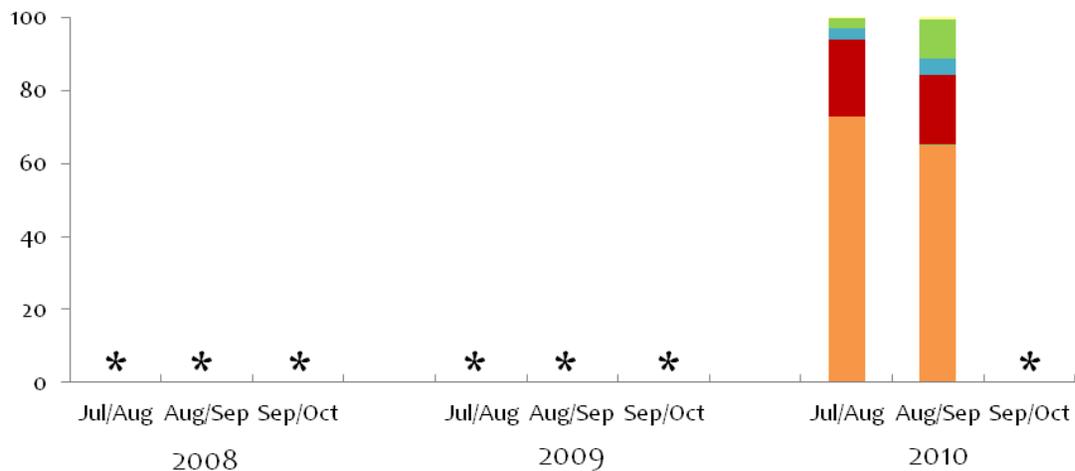
# KLONDIKE



# BURGER



# STATOIL

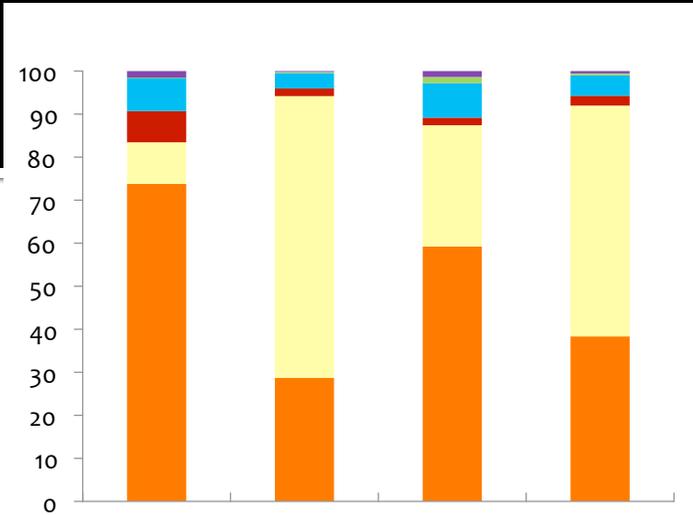
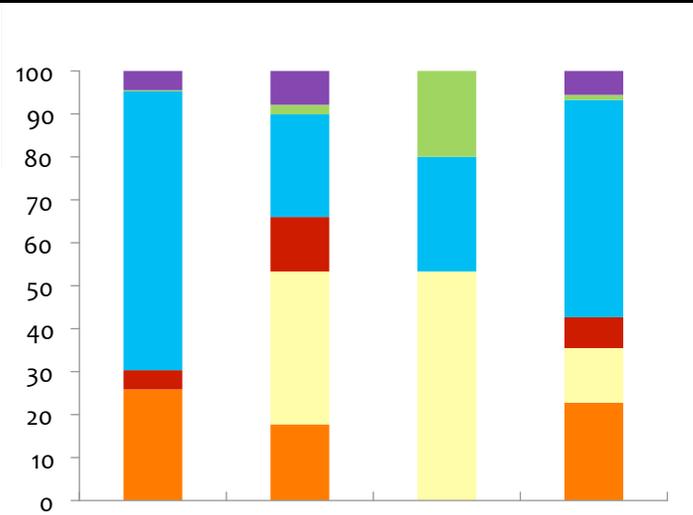


SEASON/YEAR

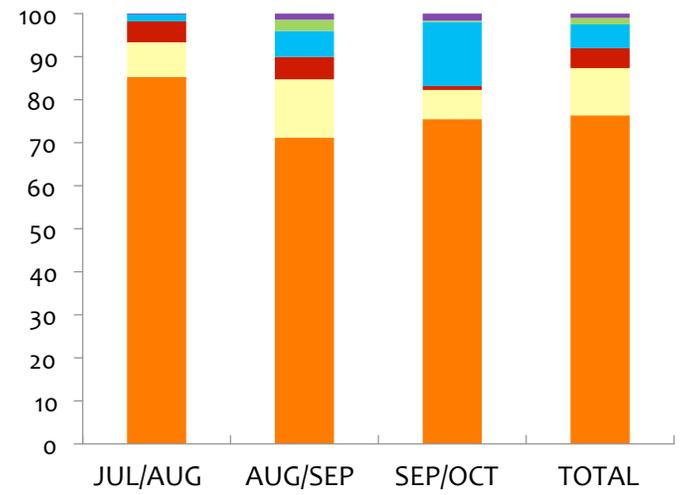
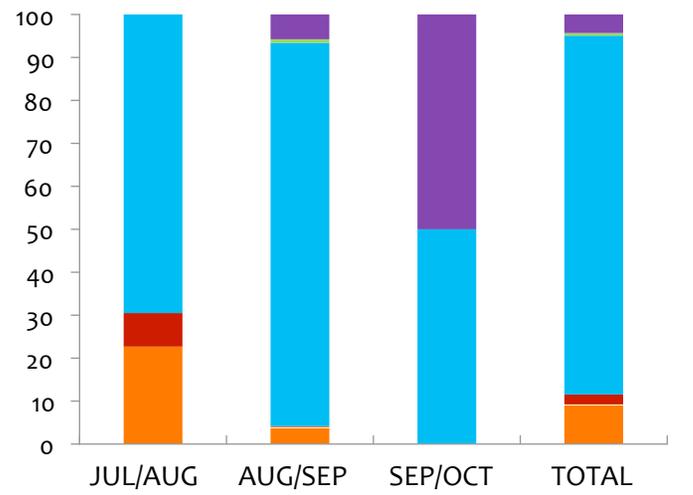
# NPPSD (<1995?)

# CSESP (>2007)

KLONDIKE



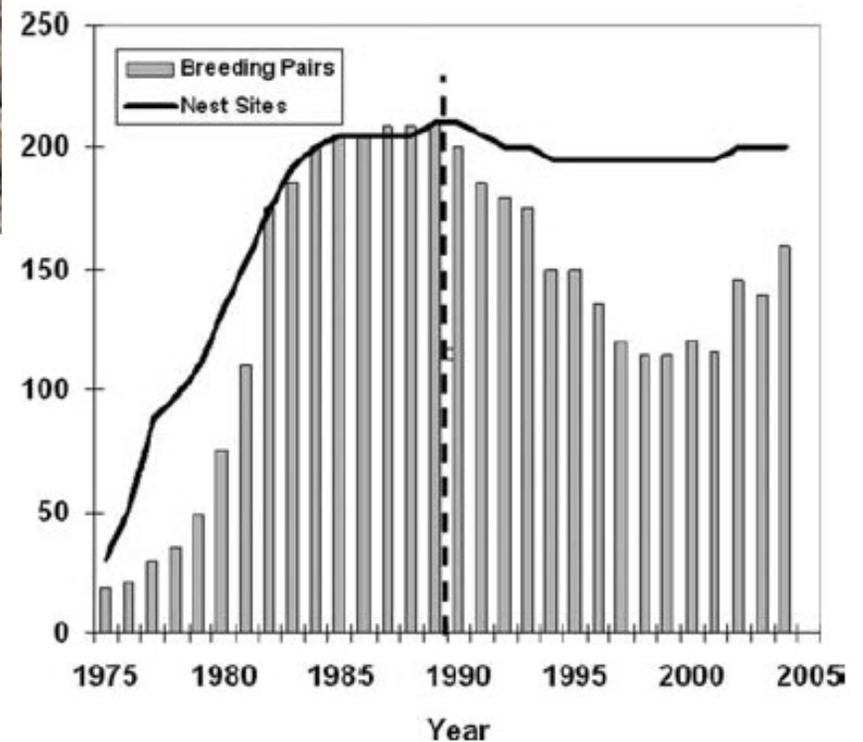
BURGER/STATOIL

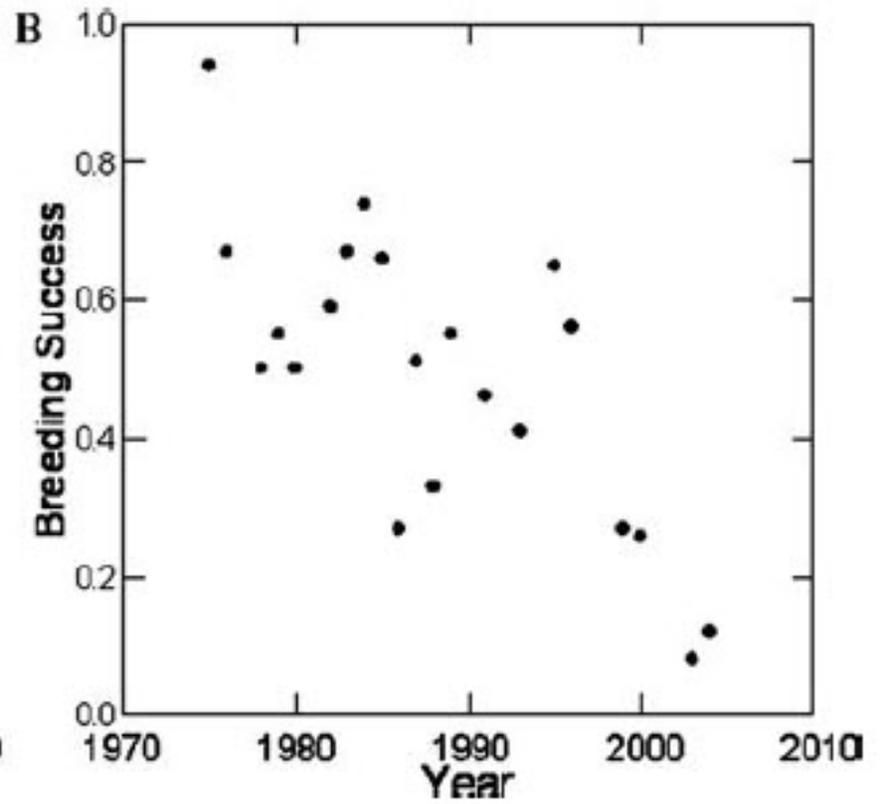
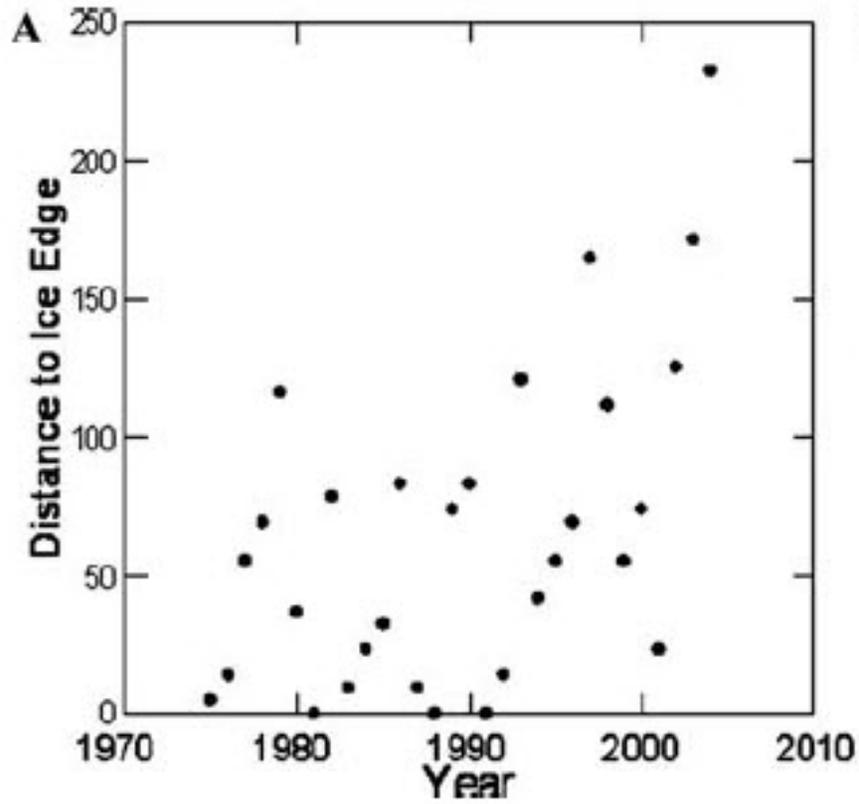


- Alcids
- Tubenoses
- Phalaropes
- Larids
- Loons
- Waterfowl

# George Divoky

## Cooper Is.

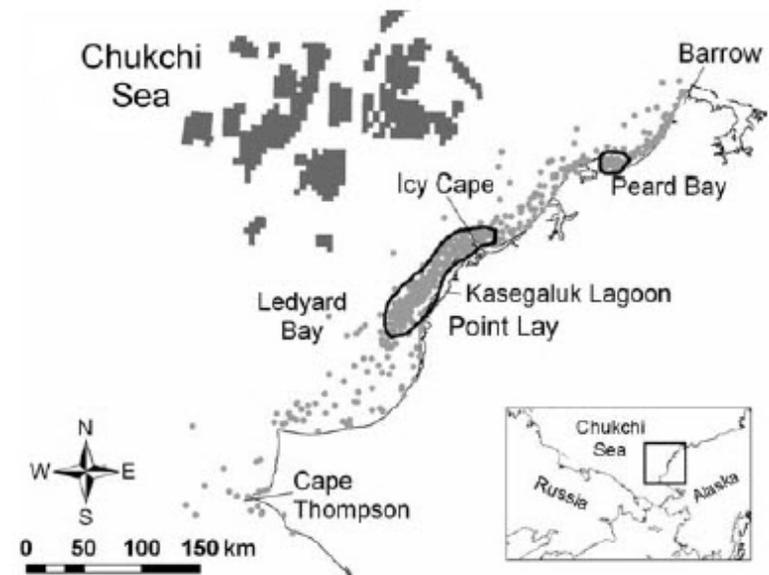
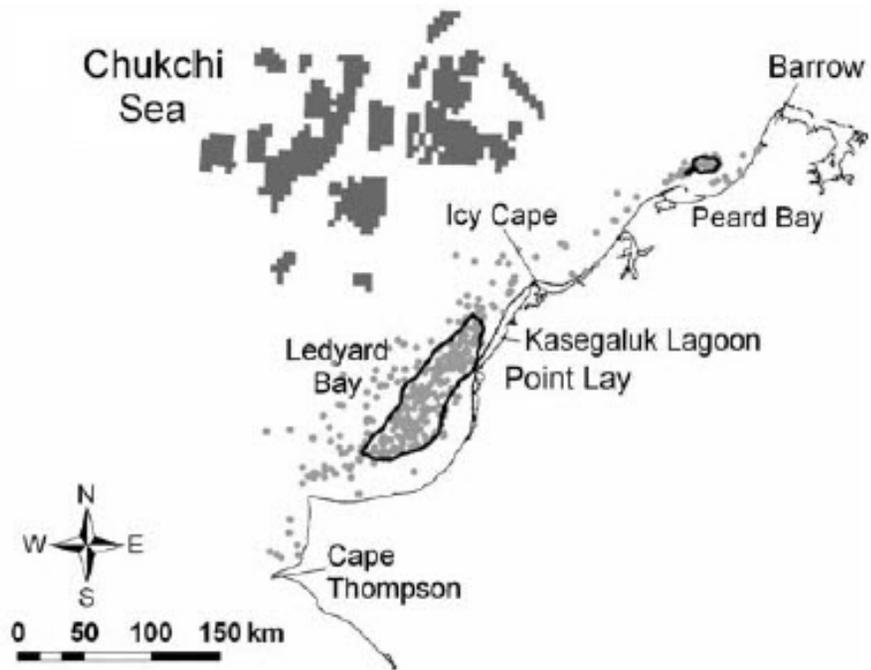




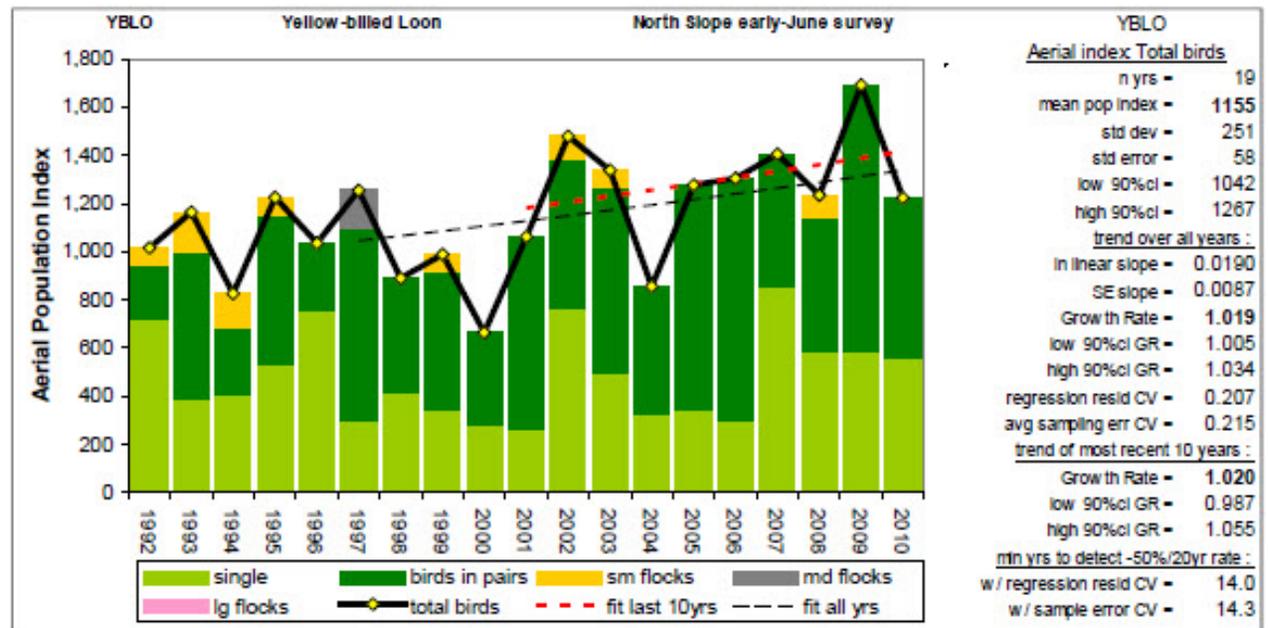
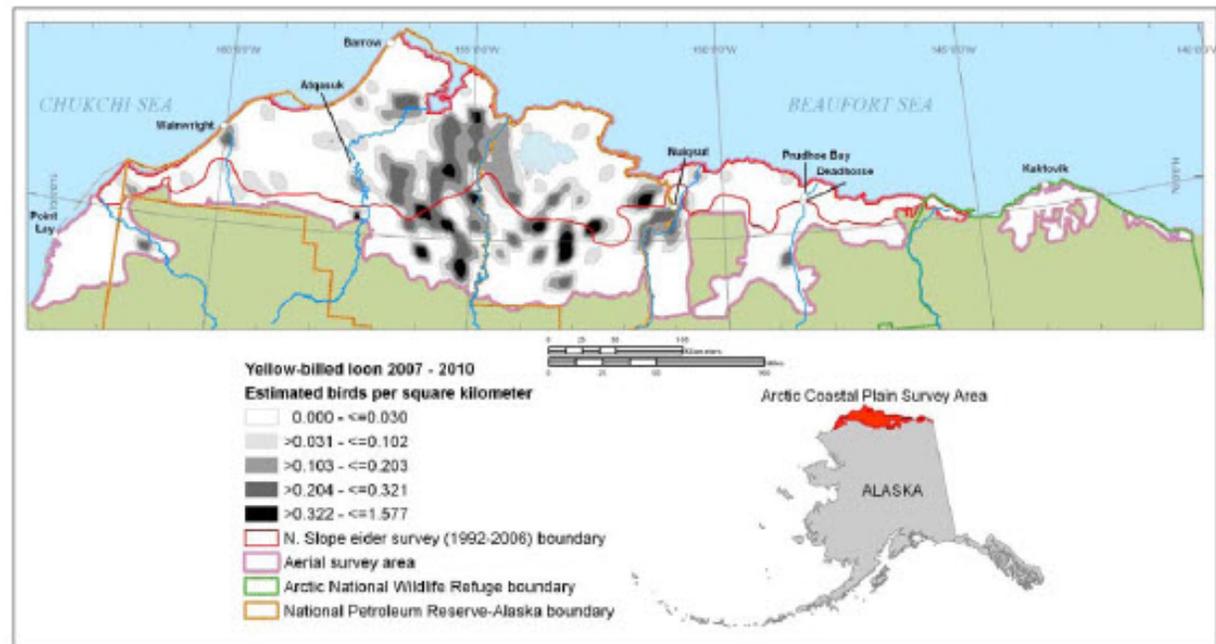
# Oppel et al. 2009

## King Eider Migration

Polar Biol (2009) 32:775–783



# Yellow-billed Loon (and other marine birds)



# Selected important fish species in the Beaufort/Chukchi Seas

## Subsistence

- Whitefish
- Cisco
- Cod
- Crab
- Salmon
- Herring
- Smelt
- Dolly varden
- + ?

## Mam./bird food

- Cod
- Herring
- Flatfish
- Eelpout
- Capelin
- Clam
- Crab
- Shrimp
- + many more

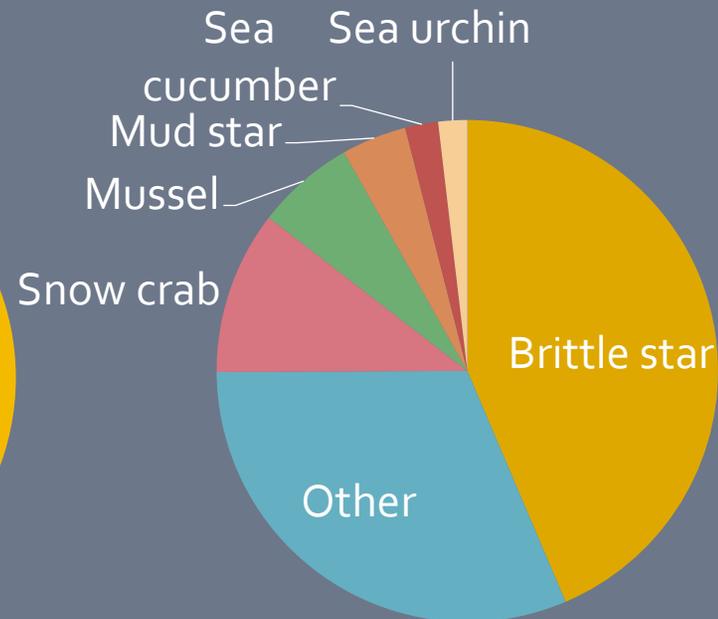
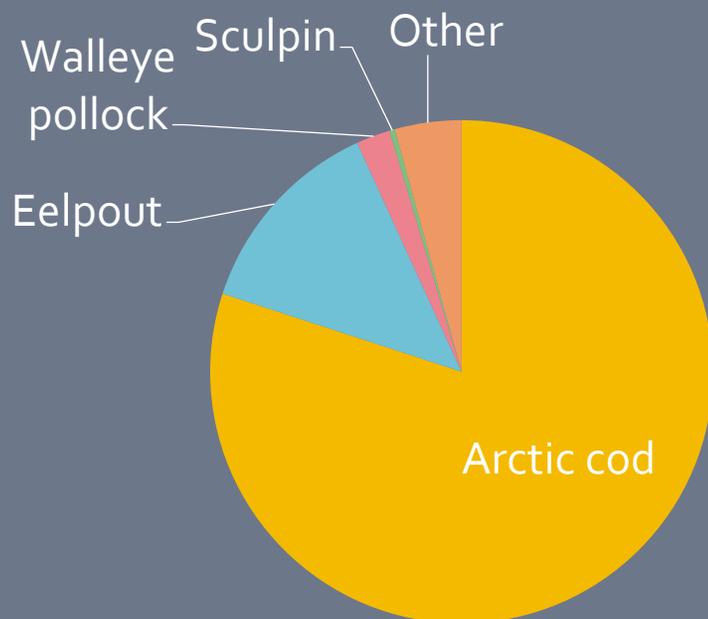
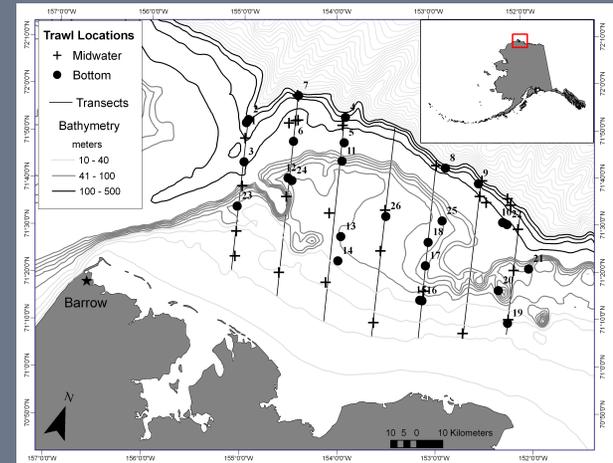
## Commercial (?)

- Whitefish
- Salmon
- Crab
- Walleye pollock
- Cod
- + ?

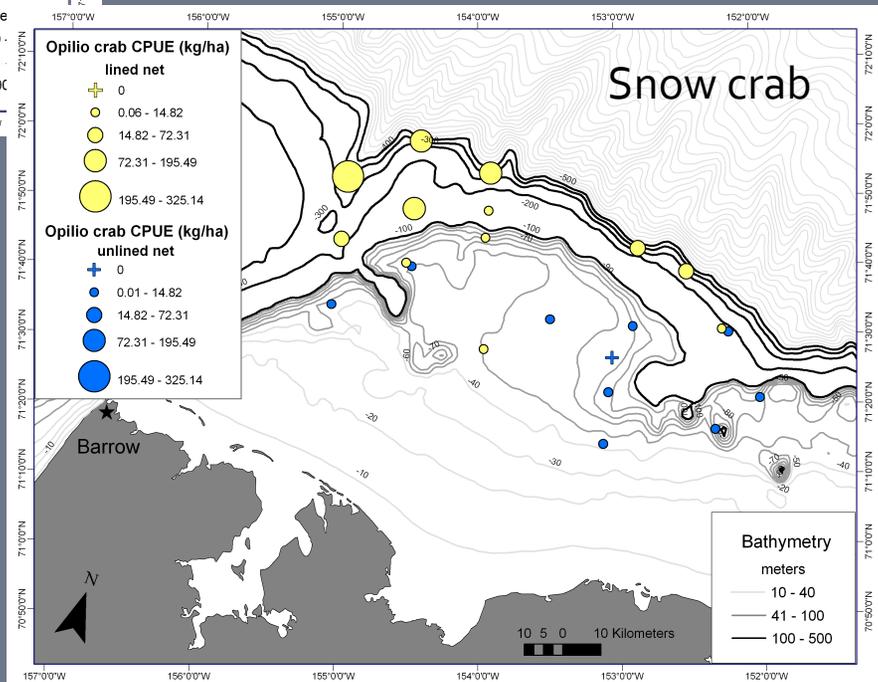
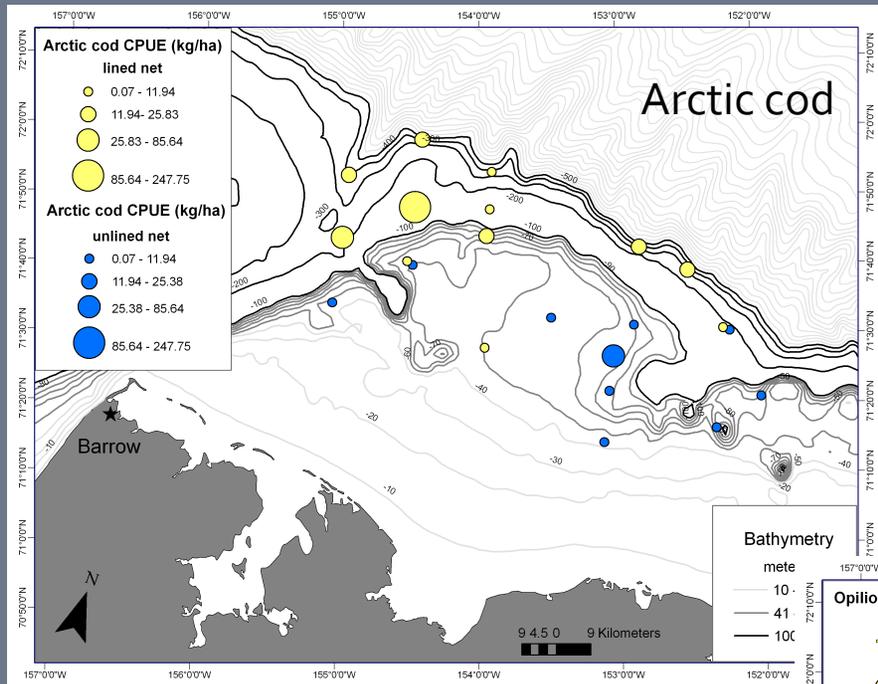
# Fish Distribution, Western Beaufort Sea

AFSC surveys, 2008

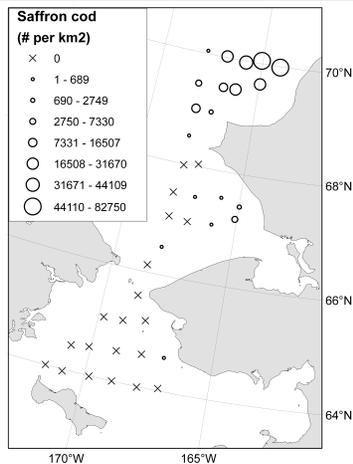
- Bottom trawl
- Funded by BOEM (MMS)



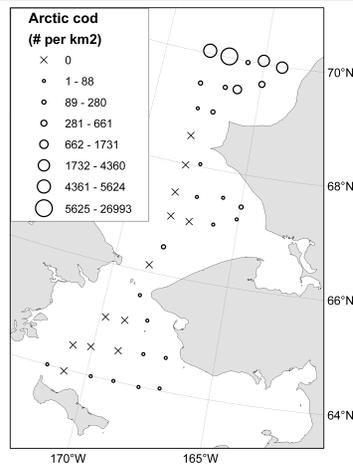
# Fish Distribution, Western Beaufort Sea Continued



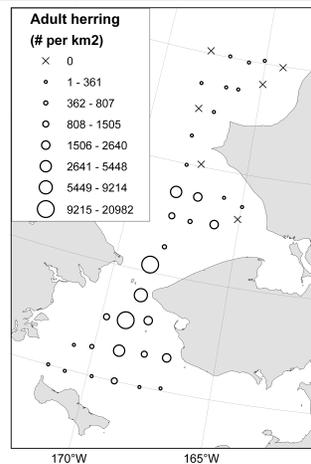
# Fish Distribution, Chukchi Sea



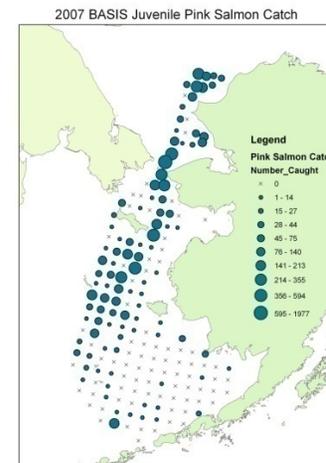
Saffron cod



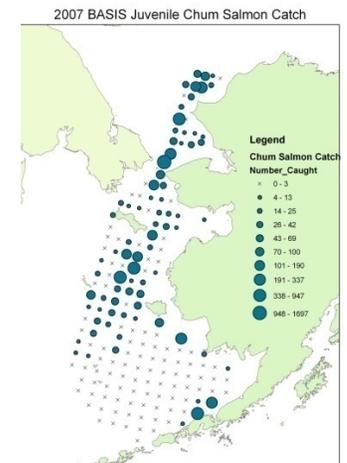
Arctic cod



Adult herring



Juvenile pink salmon



Juvenile chum salmon

AFSC surveys in 2007 collected. . .

- Physical oceanography
- Biological oceanography.
- Fish distribution
- Relative abundance
- Fish diet
- Size
- Energetics



# Endicott Fish Monitoring

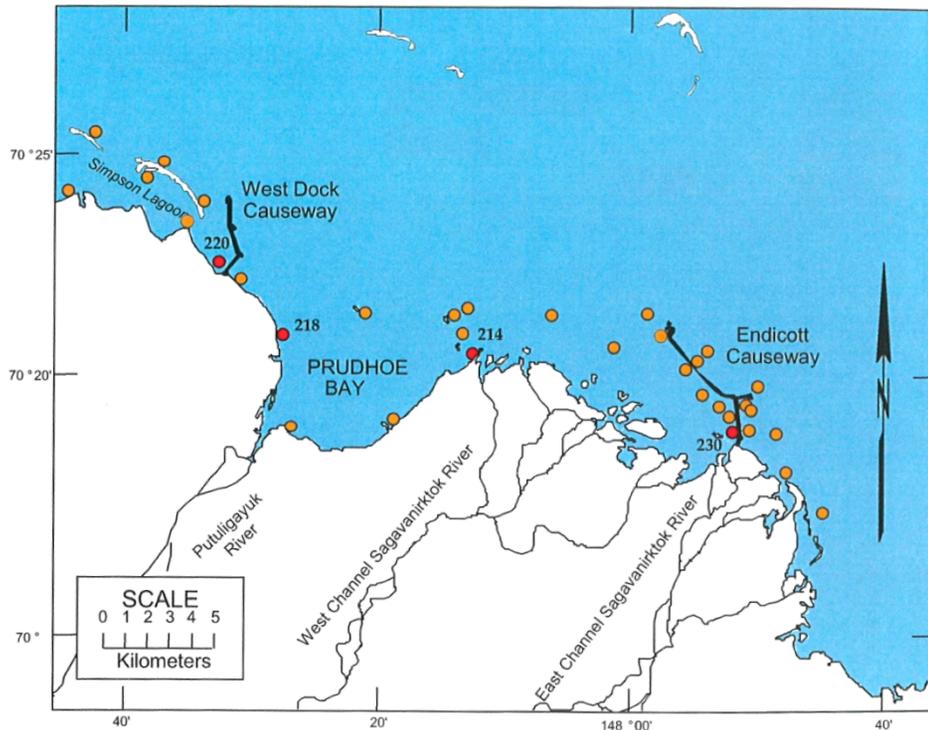


Figure 11-1. Sites sampled by fyke net in summer 1985–1998 and 2001–2009. Sites sampled in 2009 are denoted by red symbols.

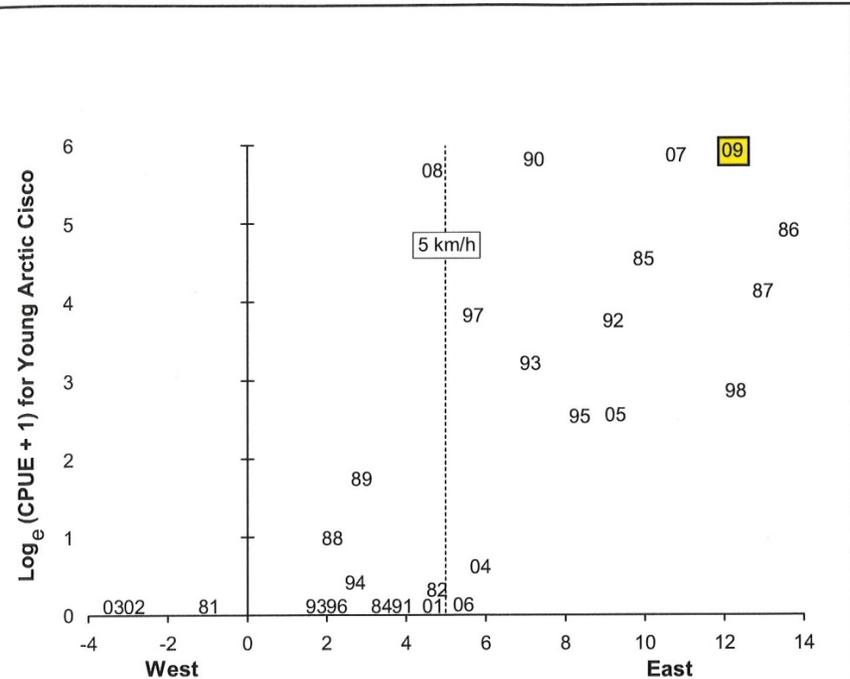


Figure 11-4  $\text{Log}_e(\text{CPUE}+1)$  of young arctic cisco for each year since 1981 plotted against dominant summer wind direction and wind strength.  $\text{Log}_e(\text{CPUE}+1)$  can be thought of as an index of fish abundance. The result for 2009 is highlighted in yellow. (Note: No data were collected in 1999–2000.)

# Observed responses to declines in sea ice

## ❖ Ringed seals

- Reproductive rates & survival rates decrease at Arctic extremes

## ❖ Polar bears

- Decrease in cub & “old bear” survival; increase in weaning age; decrease in body condition
- More polar bears on land during the summer

## ❖ Walrus

- Switch from hauling out on sea ice to hauling out on both Chukchi Sea coasts

## ❖ Gray whales

- Shift in distribution

## ❖ Black Guillemots

- Decrease in reproductive success

# Reptiles and Amphibians

- Birds as close to reptiles as we will get, for now....
- Until climate change warms things up!

# Summary

- Data on UTL organisms are as varied as the Arctic
- Some have great data on:
  - Population size and trend
  - Movement and distribution
  - Habitat use
  - Health status
- Many data gaps but some robust data sets
- We will struggle with separating impacts from CC and industry.